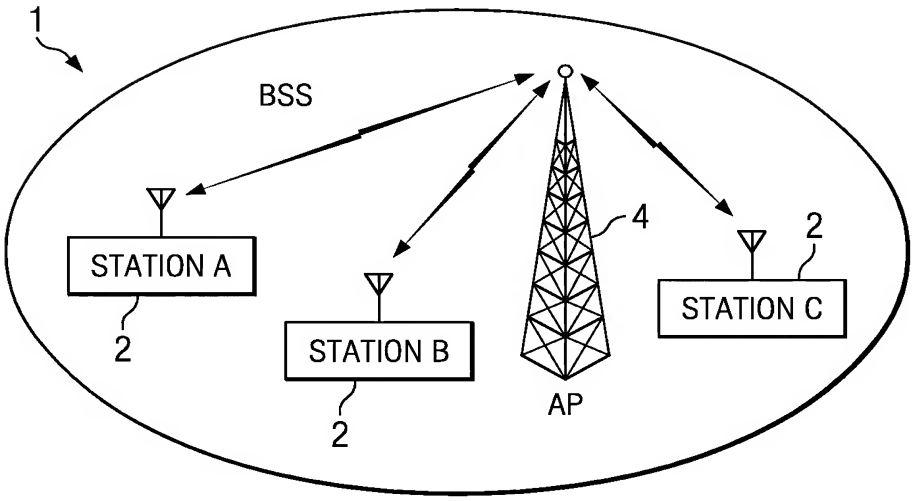


FIG. 1
(PRIOR ART)

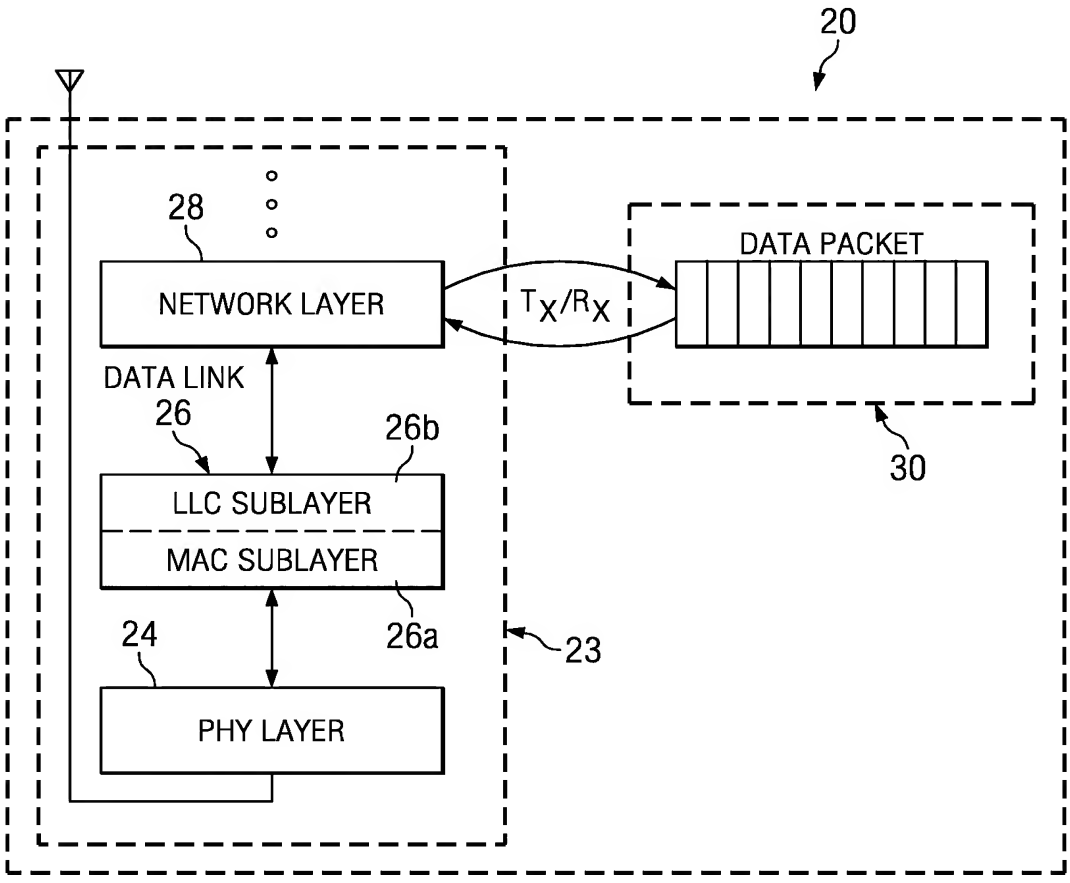


FIG. 2
(PRIOR ART)

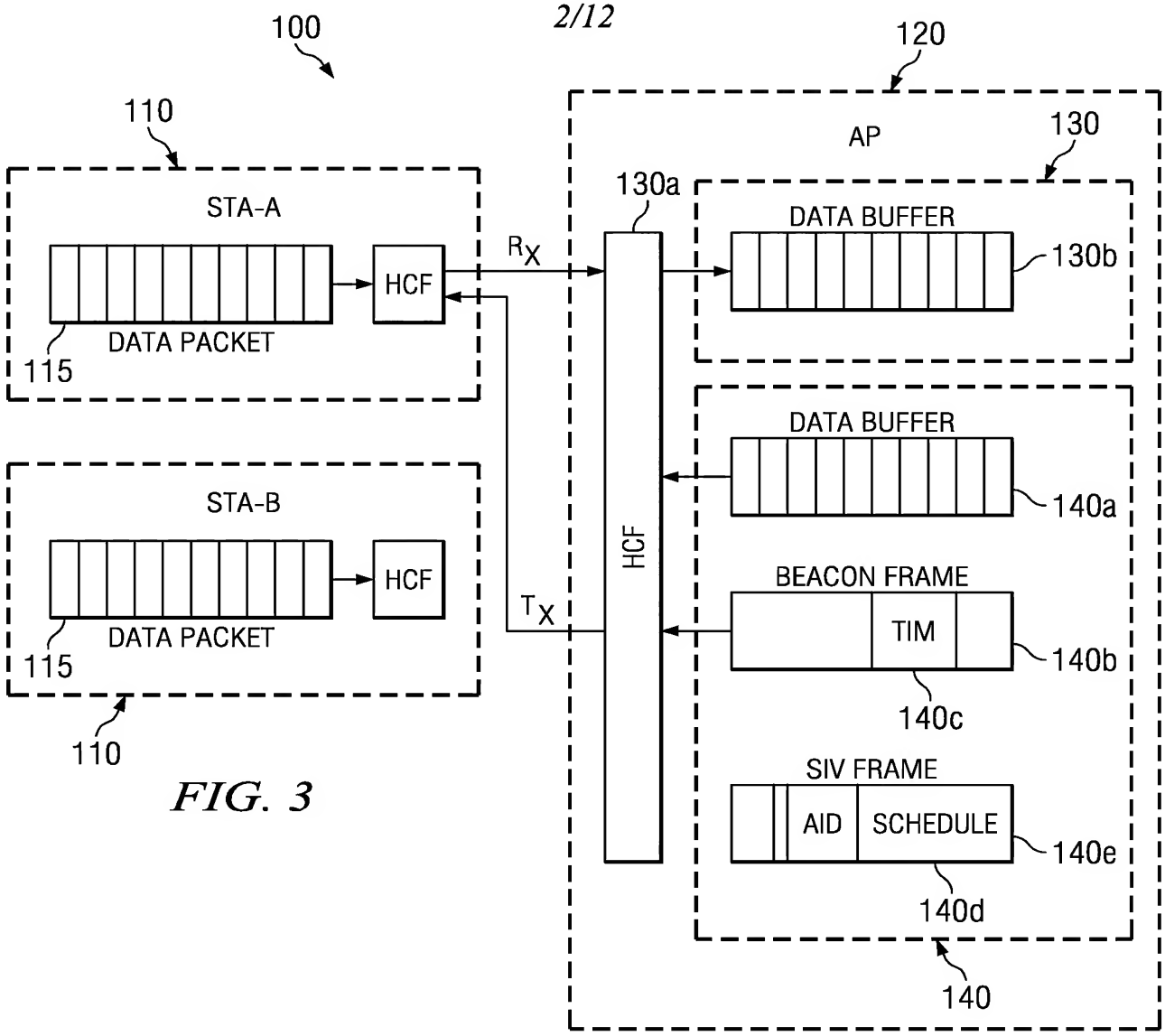


FIG. 3

INTER-FRAME SPACES FOR 802.11$_B$ DSSS (μs)

SLOT TIME	SIFS TIME	PIFS TIME	DIFS TIME
20	10	30	50

200

FIG. 4

230

FRAME BODY OF ACTION FRAME

235 FIELD NAME	240 CATEGORY CODE	245 ACTION CODE	250 ACTIVATION DELAY	255 DIALOG TOKEN	260 ACTION BODY
BYTES	1	1	1	1	0-2300

FIG. 5A

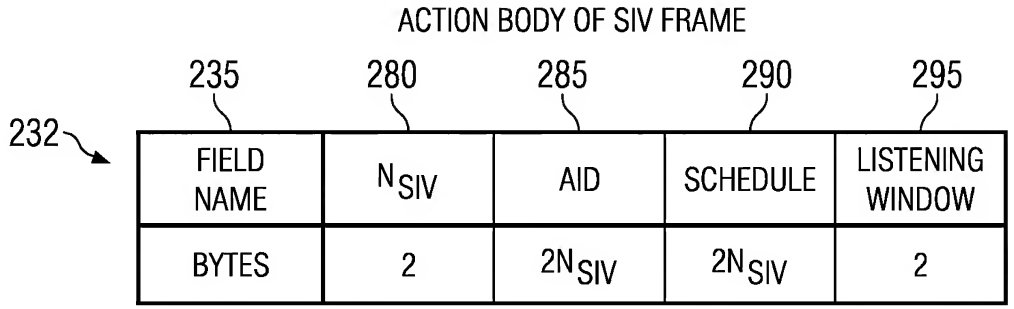

ACTION BODY OF SIV FRAME
235
280
285
290
295
232
FIELD NAME
N_{SIV}
AID
SCHEDULE
LISTENING WINDOW
BYTES
2
$2N_{SIV}$
$2N_{SIV}$
2

FIG. 5B

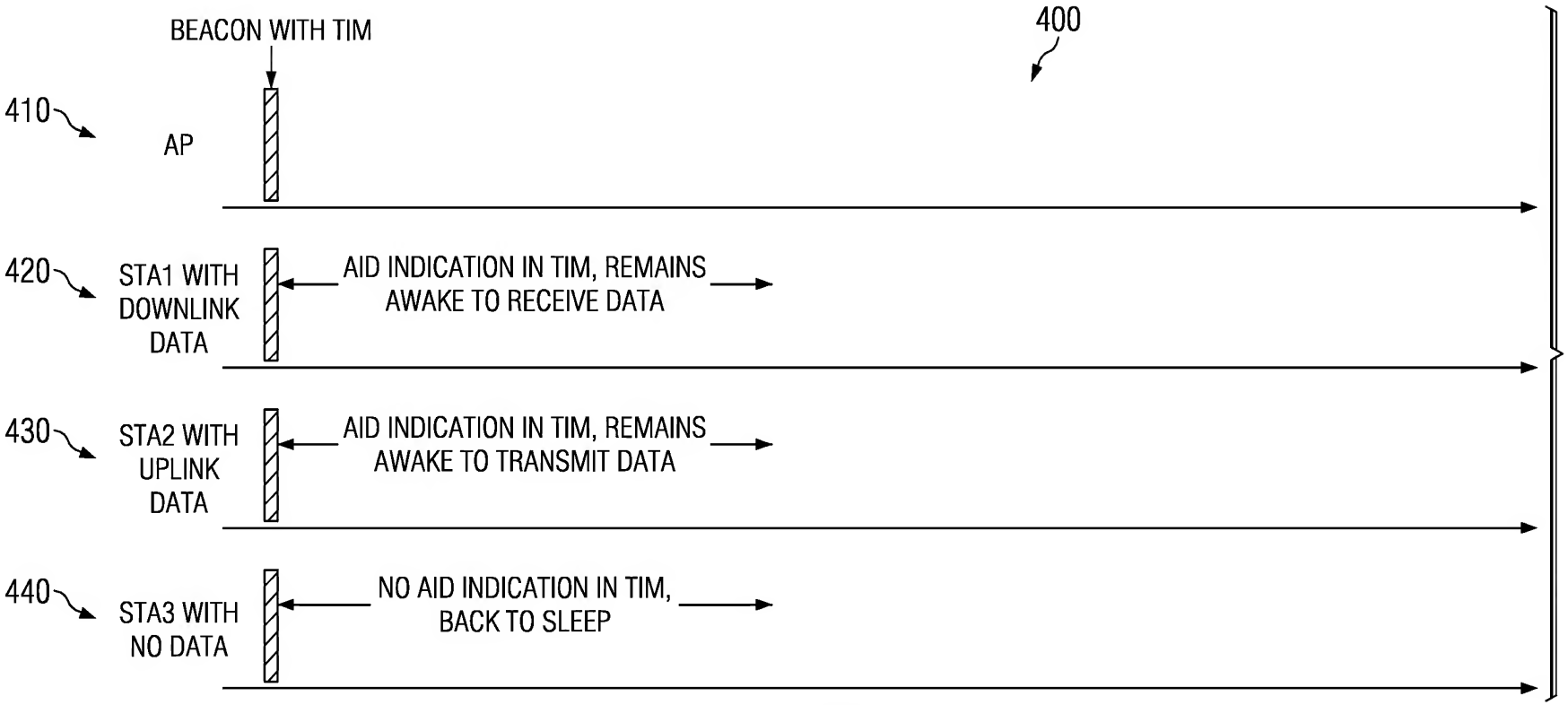

400
BEACON WITH TIM
410
AP
420
STA1 WITH DOWNLINK DATA
AID INDICATION IN TIM, REMAINS AWAKE TO RECEIVE DATA
430
STA2 WITH UPLINK DATA
AID INDICATION IN TIM, REMAINS AWAKE TO TRANSMIT DATA
440
STA3 WITH NO DATA
NO AID INDICATION IN TIM, BACK TO SLEEP

FIG. 6A

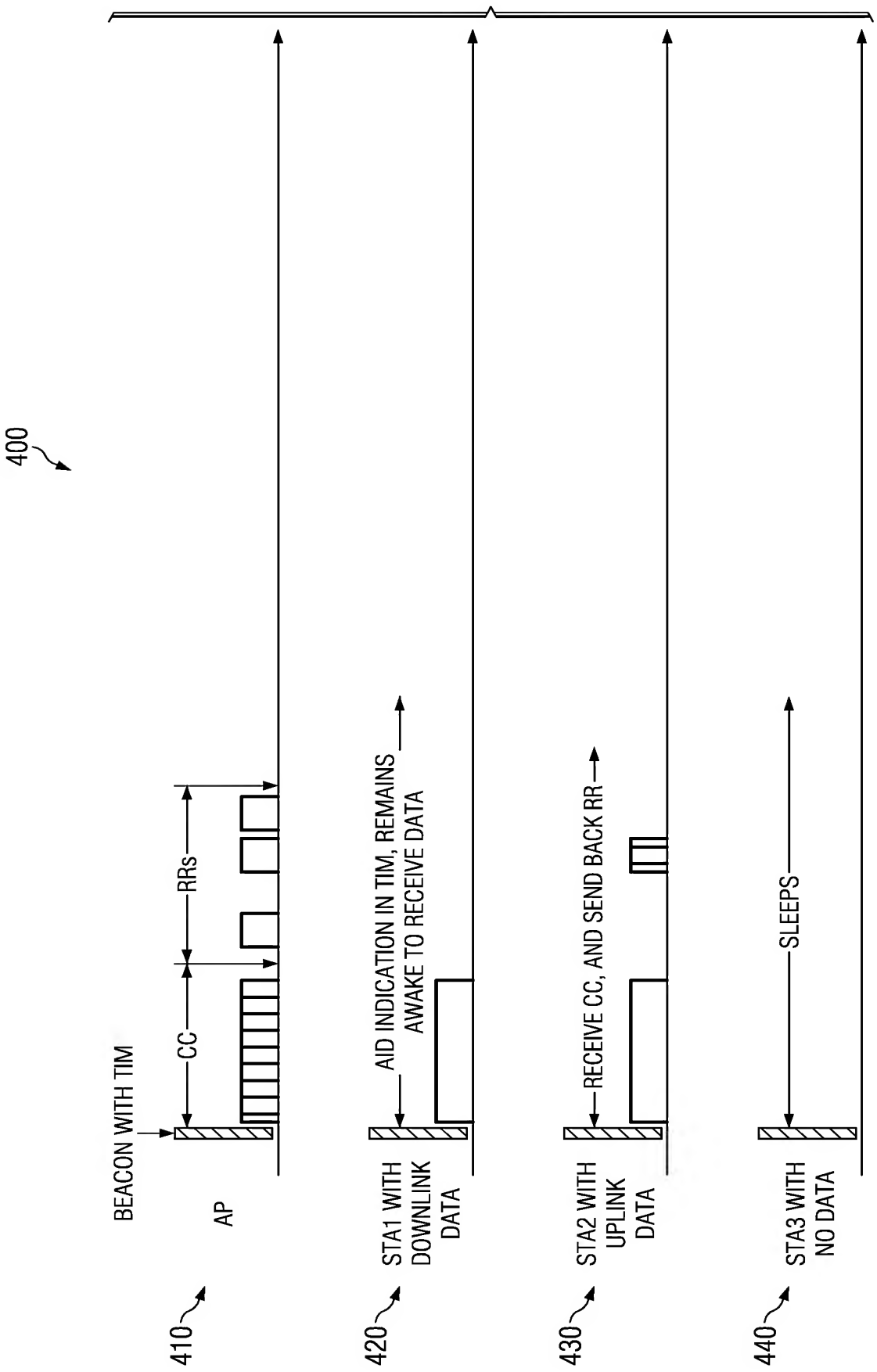

400
410
AP
BEACON WITH TIM
CC
RRs
420
STA1 WITH
DOWNLINK
DATA
AID INDICATION IN TIM, REMAINS
AWAKE TO RECEIVE DATA
430
STA2 WITH
UPLINK
DATA
RECEIVE CC, AND SEND BACK RR
440
STA3 WITH
NO DATA
SLEEPS

FIG. 6B

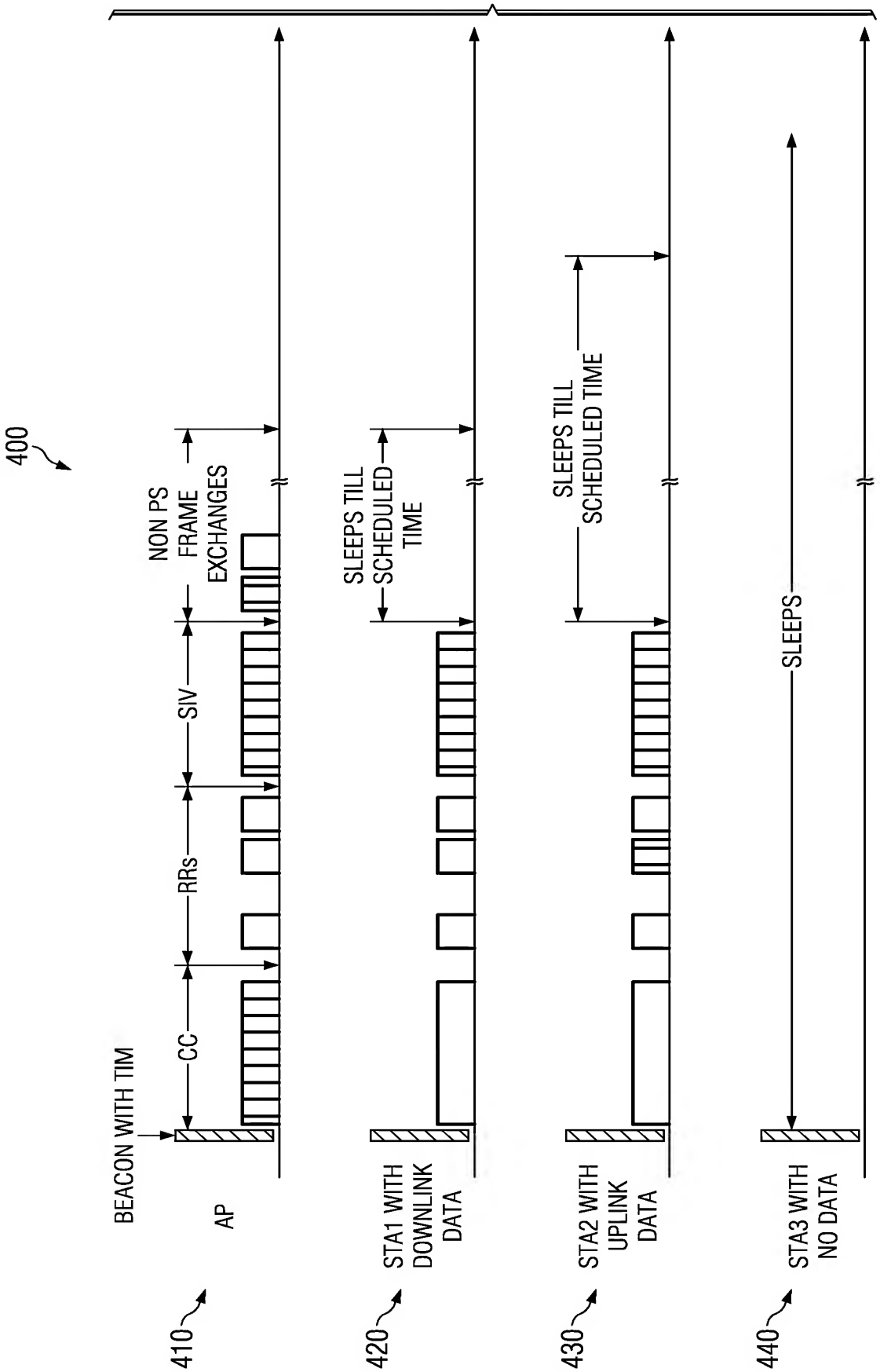

400
BEACON WITH TIM
CC
RRs
SIV
NON PS FRAME EXCHANGES
AP
410
SLEEPS TILL SCHEDULED TIME
STA1 WITH DOWNLINK DATA
420
SLEEPS TILL SCHEDULED TIME
STA2 WITH UPLINK DATA
430
SLEEPS
STA3 WITH NO DATA
440

FIG. 6C

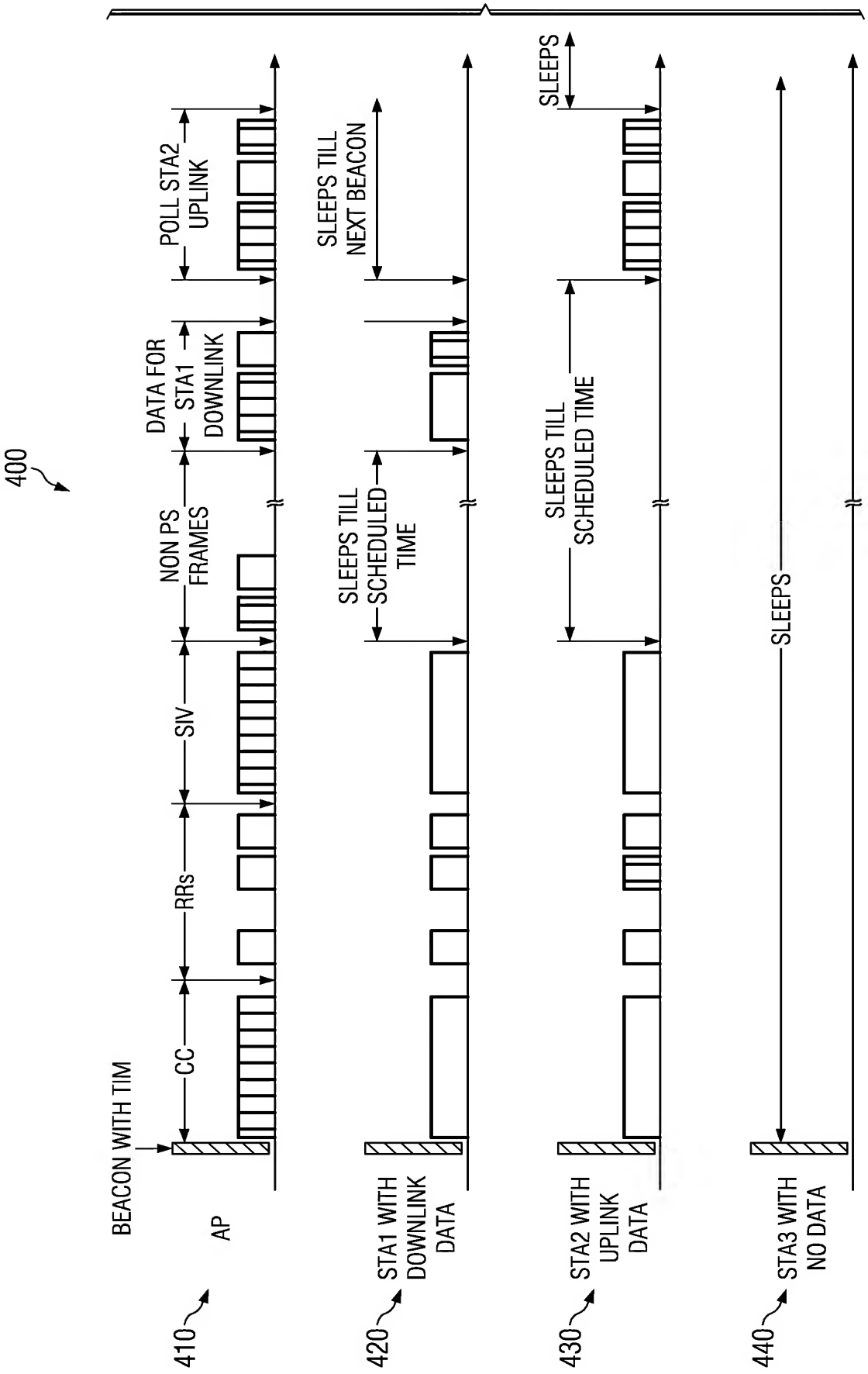
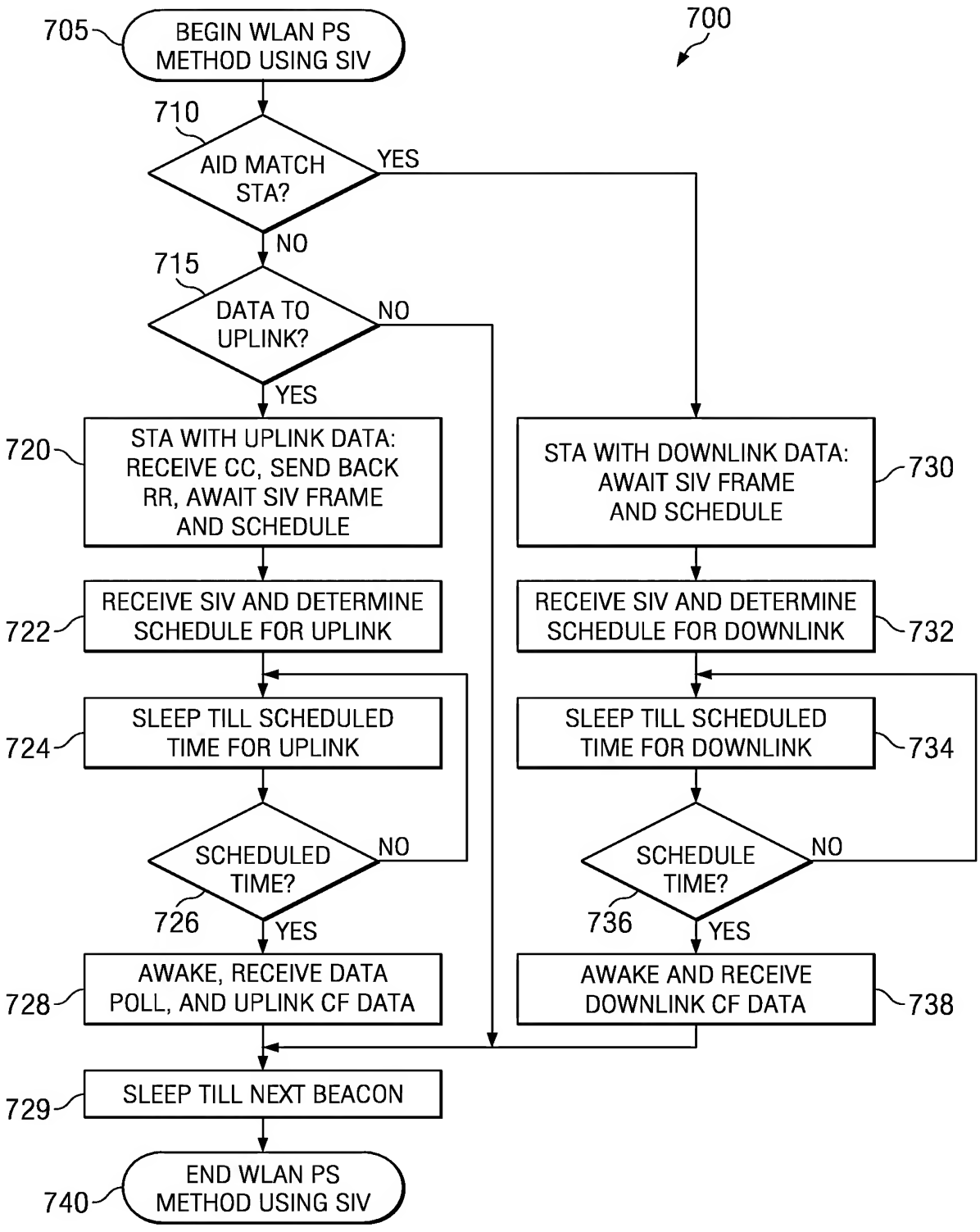

400
410
AP
BEACON WITH TIM
CC
RRs
SIV
NON PS FRAMES
DATA FOR STA1 DOWNLINK
POLL STA2 UPLINK
420
STA1 WITH DOWNLINK DATA
SLEEPS TILL SCHEDULED TIME
SLEEPS TILL NEXT BEACON
430
STA2 WITH UPLINK DATA
SLEEPS TILL SCHEDULED TIME
SLEEPS
440
STA3 WITH NO DATA
SLEEPS

FIG. 6D

FIG. 7


700
705
BEGIN WLAN PS METHOD USING SIV
710
AID MATCH STA?
YES
NO
715
DATA TO UPLINK?
NO
YES
720
STA WITH UPLINK DATA: RECEIVE CC, SEND BACK RR, AWAIT SIV FRAME AND SCHEDULE
722
RECEIVE SIV AND DETERMINE SCHEDULE FOR UPLINK
724
SLEEP TILL SCHEDULED TIME FOR UPLINK
SCHEDULED TIME?
NO
726
YES
728
AWAKE, RECEIVE DATA POLL, AND UPLINK CF DATA
730
STA WITH DOWNLINK DATA: AWAIT SIV FRAME AND SCHEDULE
732
RECEIVE SIV AND DETERMINE SCHEDULE FOR DOWNLINK
734
SLEEP TILL SCHEDULED TIME FOR DOWNLINK
SCHEDULE TIME?
NO
736
YES
738
AWAKE AND RECEIVE DOWNLINK CF DATA
729
SLEEP TILL NEXT BEACON
740
END WLAN PS METHOD USING SIV

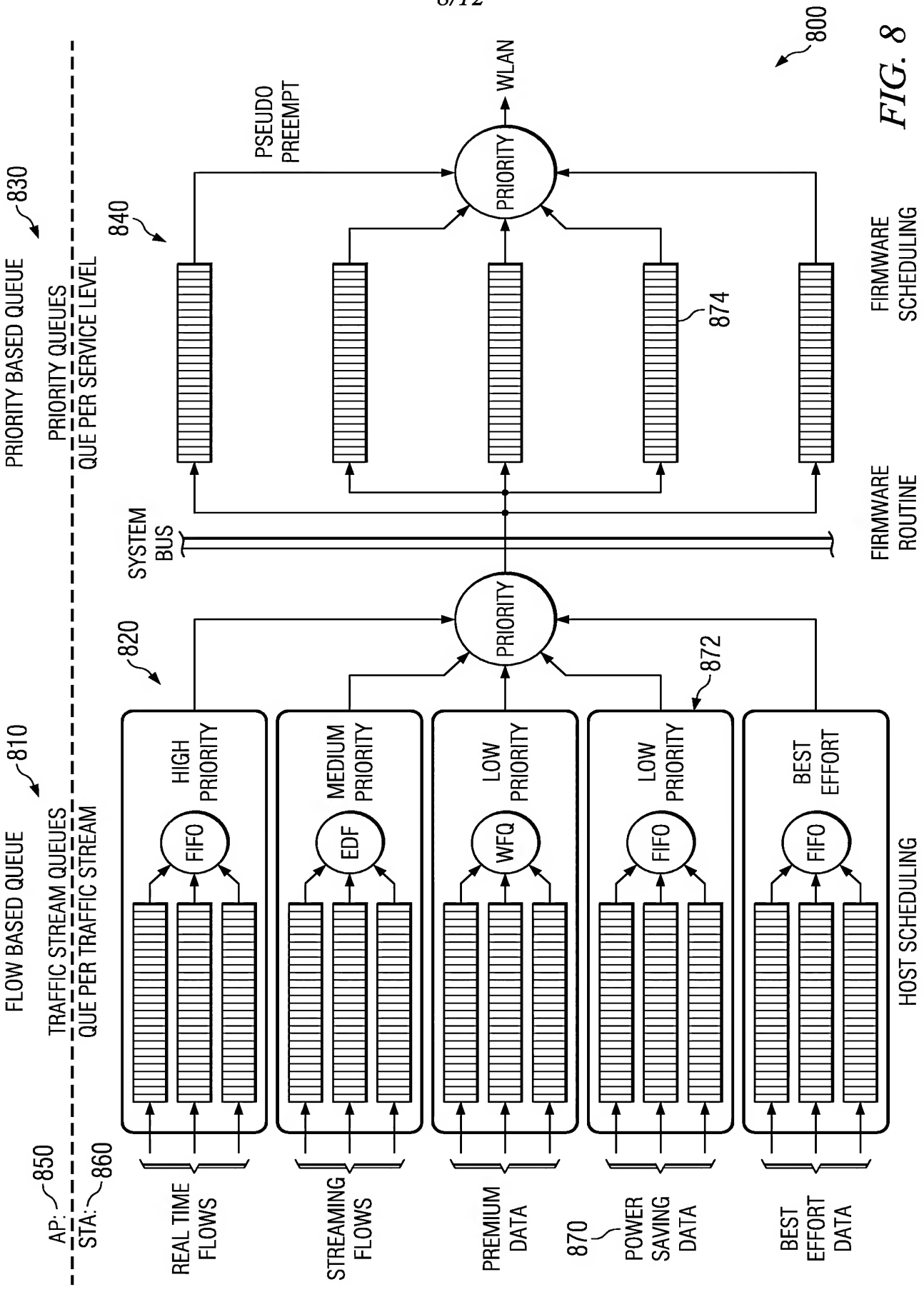

800
PRIORITY BASED QUEUE
830
PRIORITY QUEUES
QUE PER SERVICE LEVEL
840
PSEUDO PREEMPT
PRIORITY
WLAN
874
FIRMWARE SCHEDULING
SYSTEM BUS
FIRMWARE ROUTINE
820
PRIORITY
872
FLOW BASED QUEUE
810
TRAFFIC STREAM QUEUES
QUE PER TRAFFIC STREAM
HIGH PRIORITY
FIFO
MEDIUM PRIORITY
EDF
LOW PRIORITY
WFQ
LOW PRIORITY
FIFO
BEST EFFORT
FIFO
HOST SCHEDULING
AP:
850
STA:
860
REAL TIME FLOWS
STREAMING FLOWS
PREMIUM DATA
870
POWER SAVING DATA
BEST EFFORT DATA

FIG. 8

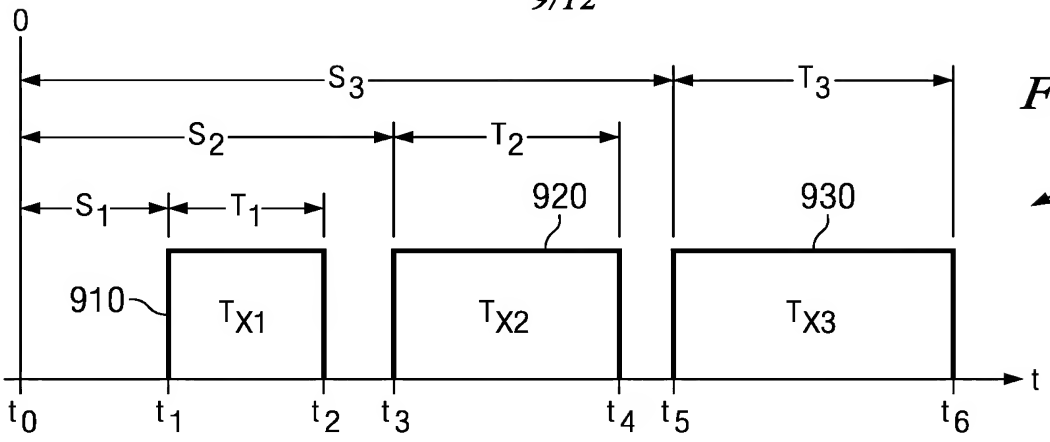


FIG. 9

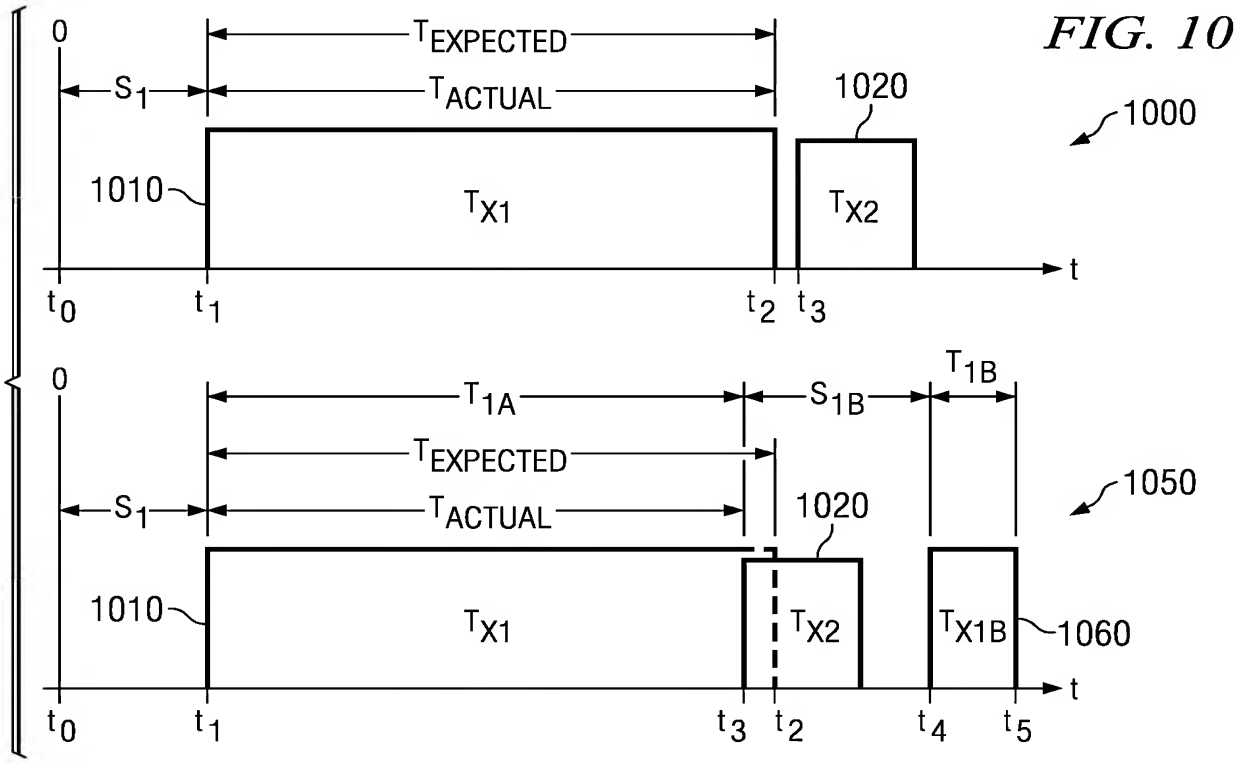


FIG. 10

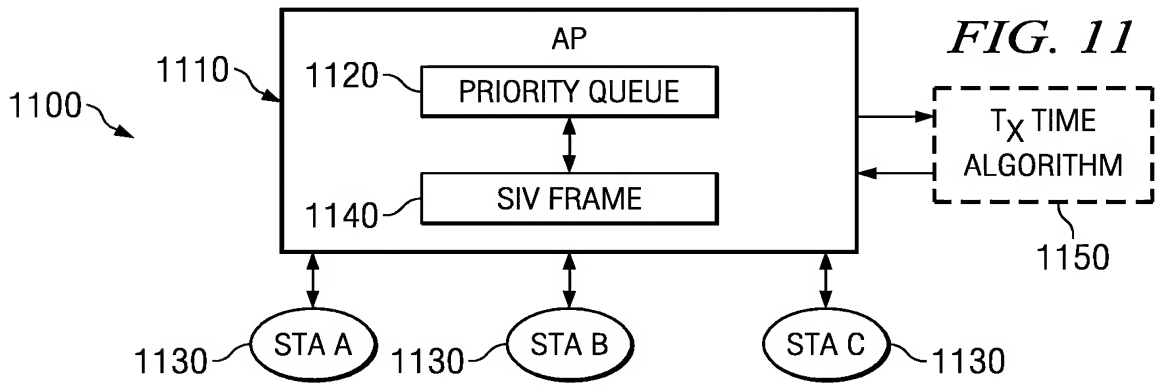


FIG. 11

FIG. 12

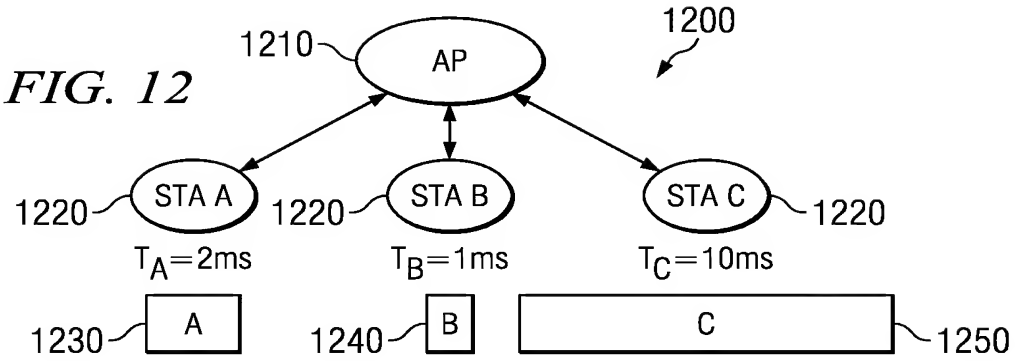


FIG. 13

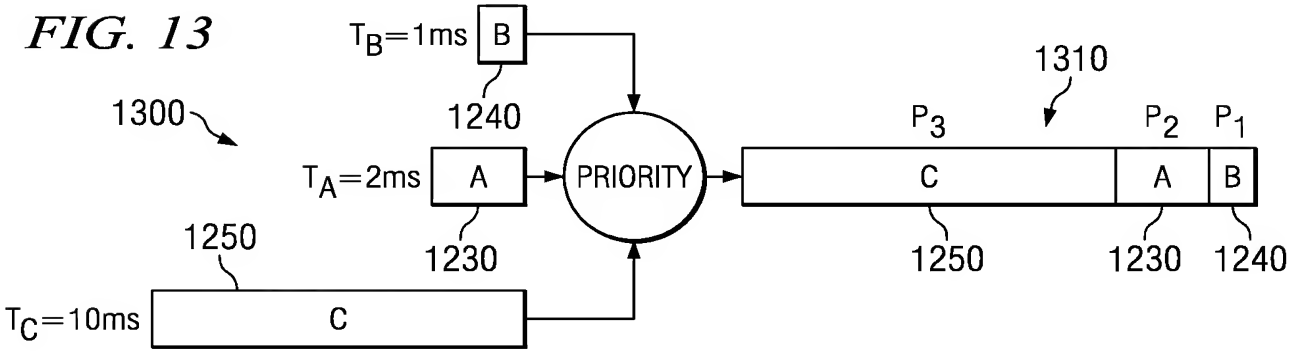


FIG. 14

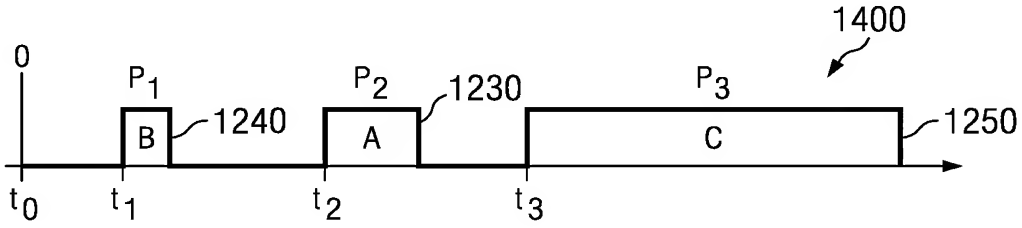
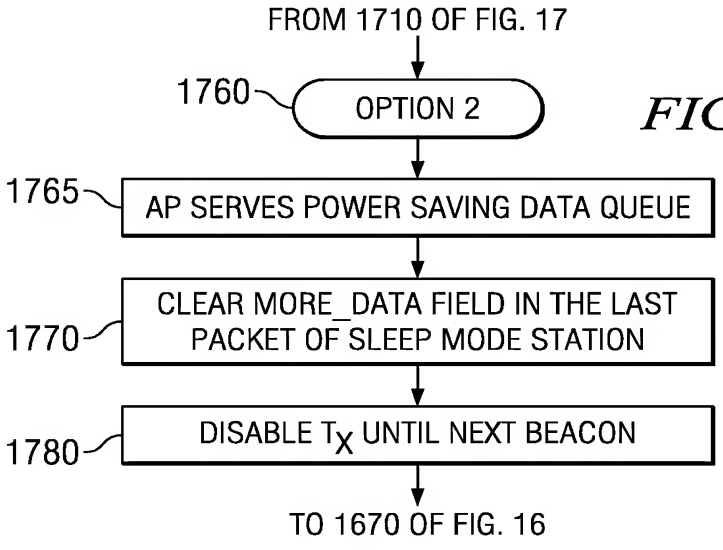


FIG. 18



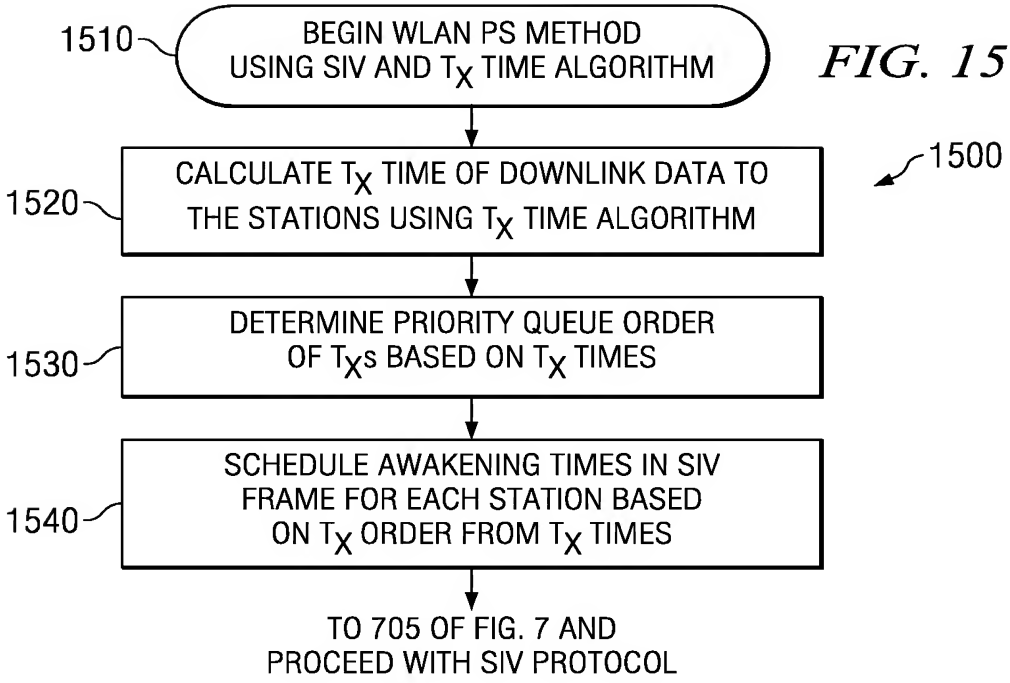

1510
BEGIN WLAN PS METHOD USING SIV AND T_X TIME ALGORITHM
1500
1520
CALCULATE T_X TIME OF DOWNLINK DATA TO THE STATIONS USING T_X TIME ALGORITHM
1530
DETERMINE PRIORITY QUEUE ORDER OF T_Xs BASED ON T_X TIMES
1540
SCHEDULE AWAKENING TIMES IN SIV FRAME FOR EACH STATION BASED ON T_X ORDER FROM T_X TIMES
TO 705 OF FIG. 7 AND PROCEED WITH SIV PROTOCOL

FIG. 15

FIG. 16

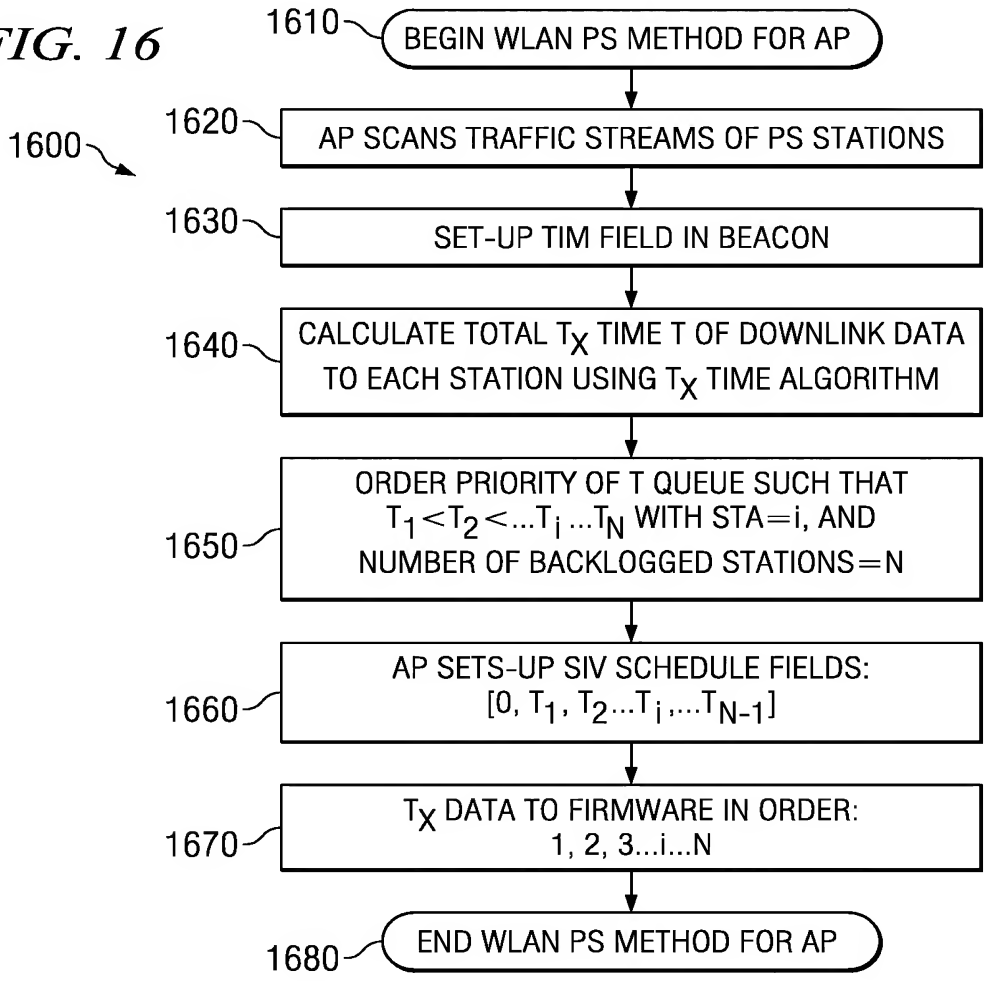

1610
BEGIN WLAN PS METHOD FOR AP
1600
1620
AP SCANS TRAFFIC STREAMS OF PS STATIONS
1630
SET-UP TIM FIELD IN BEACON
1640
CALCULATE TOTAL T_X TIME T OF DOWNLINK DATA TO EACH STATION USING T_X TIME ALGORITHM
1650
ORDER PRIORITY OF T QUEUE SUCH THAT $T_1 < T_2 < ... T_i ... T_N$ WITH STA=i, AND NUMBER OF BACKLOGGED STATIONS=N
1660
AP SETS-UP SIV SCHEDULE FIELDS: $[0, T_1, T_2 ... T_i, ... T_{N-1}]$
1670
T_X DATA TO FIRMWARE IN ORDER: 1, 2, 3...i...N
1680
END WLAN PS METHOD FOR AP

FIG. 17

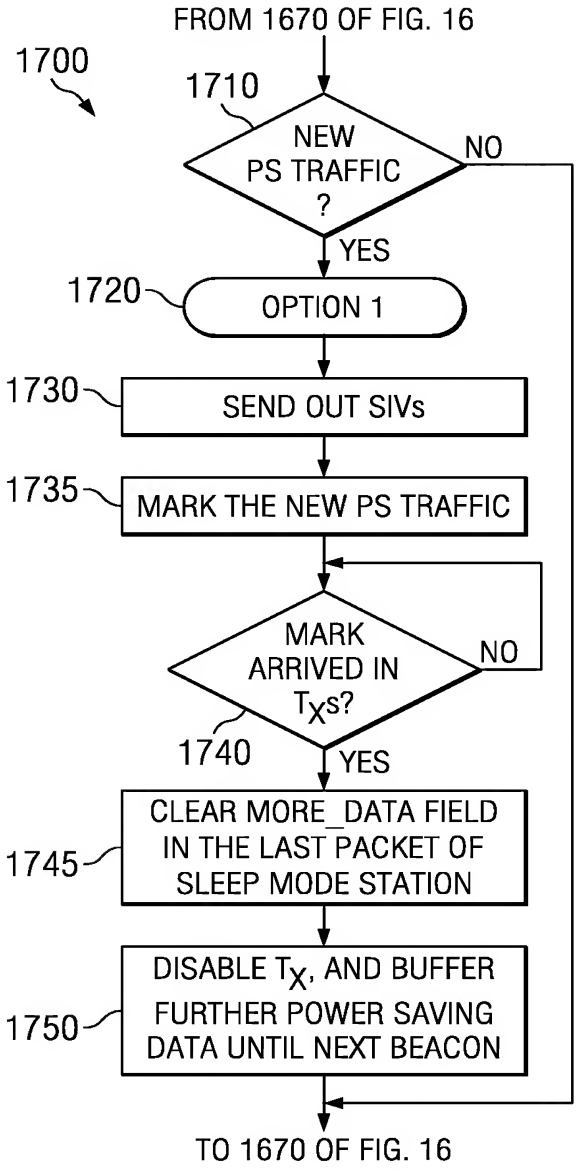
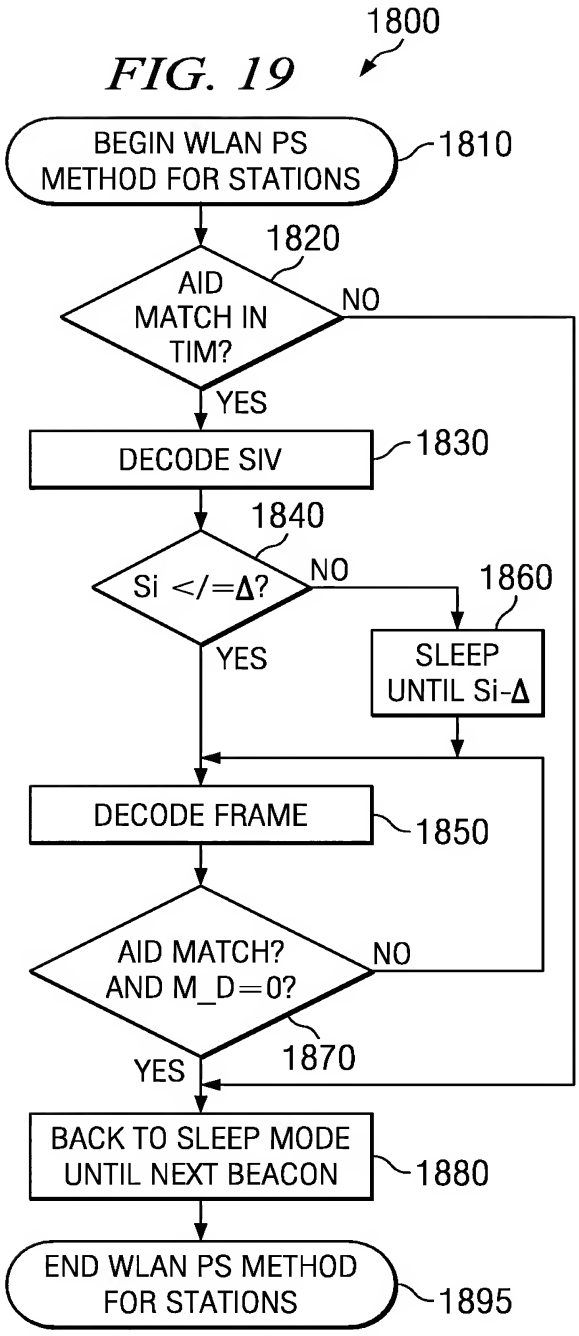

FROM 1670 OF FIG. 16
1700
1710
NEW PS TRAFFIC ?
NO
YES
1720
OPTION 1
1730
SEND OUT SIVs
1735
MARK THE NEW PS TRAFFIC
MARK ARRIVED IN T_Xs?
NO
1740
YES
1745
CLEAR MORE_DATA FIELD IN THE LAST PACKET OF SLEEP MODE STATION
1750
DISABLE T_X, AND BUFFER FURTHER POWER SAVING DATA UNTIL NEXT BEACON
TO 1670 OF FIG. 16

FIG. 19


1800
BEGIN WLAN PS METHOD FOR STATIONS
1810
1820
AID MATCH IN TIM?
NO
YES
DECODE SIV
1830
1840
Si </=Δ?
NO
1860
YES
SLEEP UNTIL Si-Δ
DECODE FRAME
1850
AID MATCH? AND M_D=0?
NO
YES
1870
BACK TO SLEEP MODE UNTIL NEXT BEACON
1880
END WLAN PS METHOD FOR STATIONS
1895